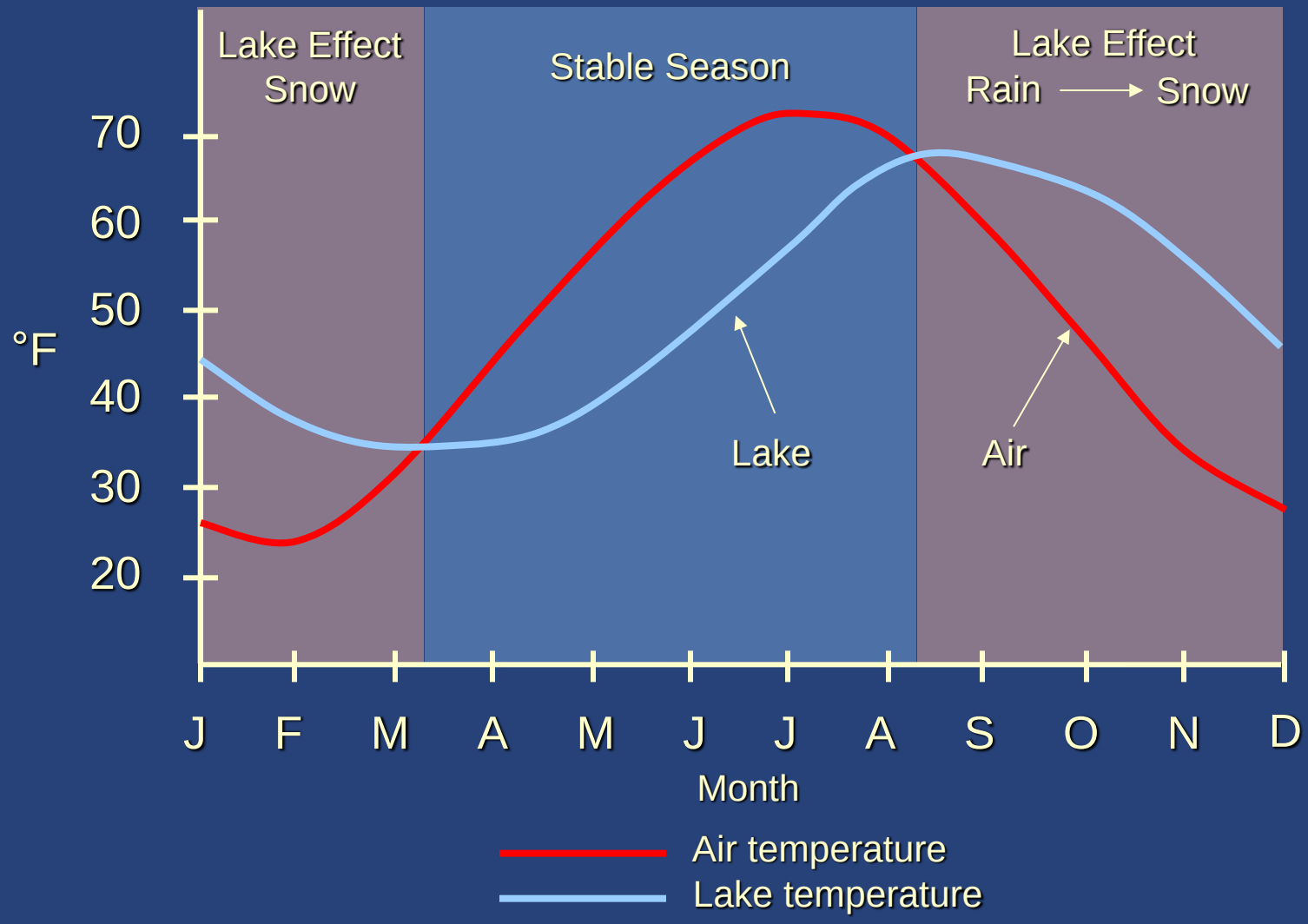
Snowfall Forecasting challenges in the Great Lakes

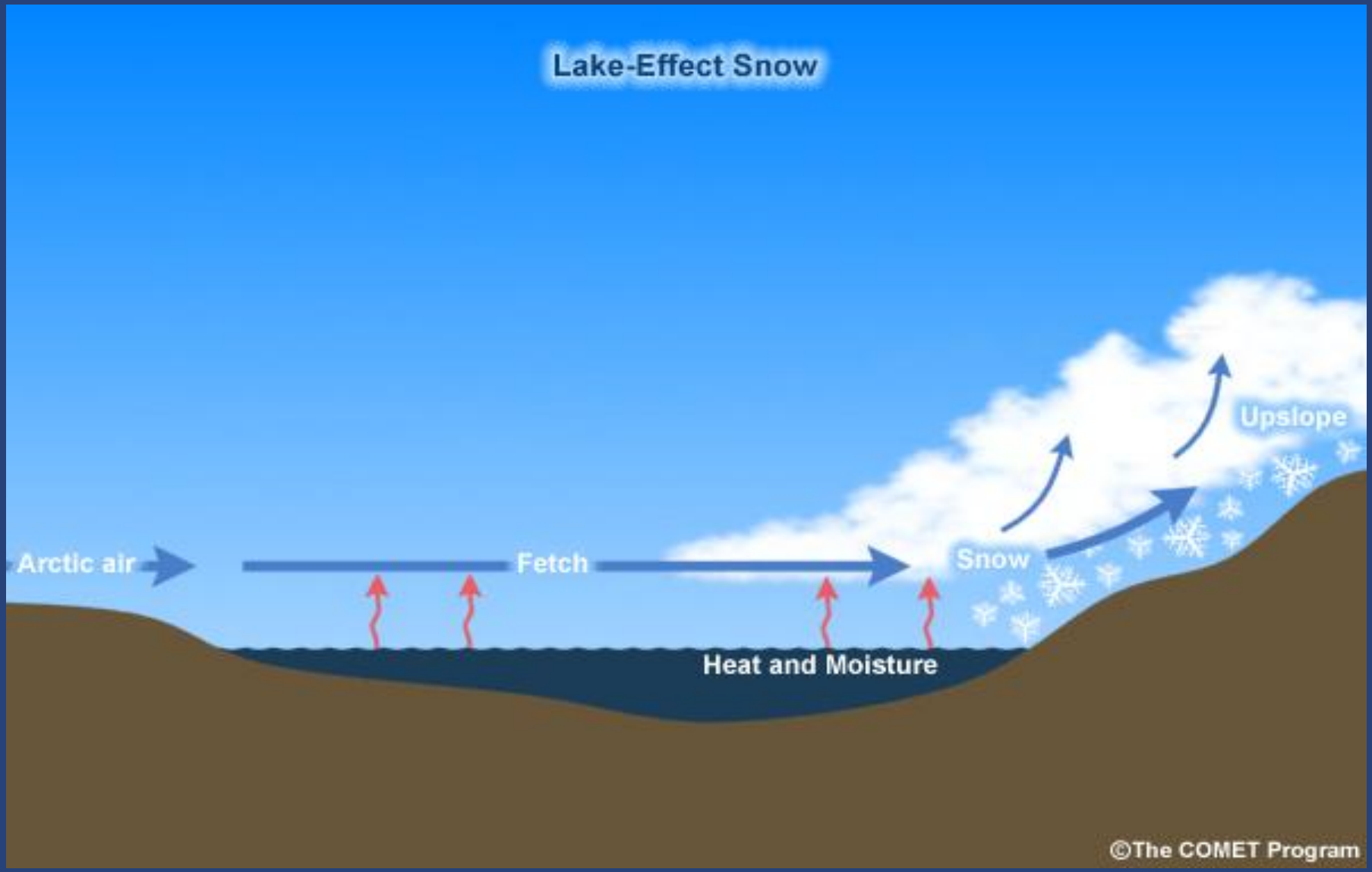
NWS Gaylord

Mean Lake/Air Temperatures

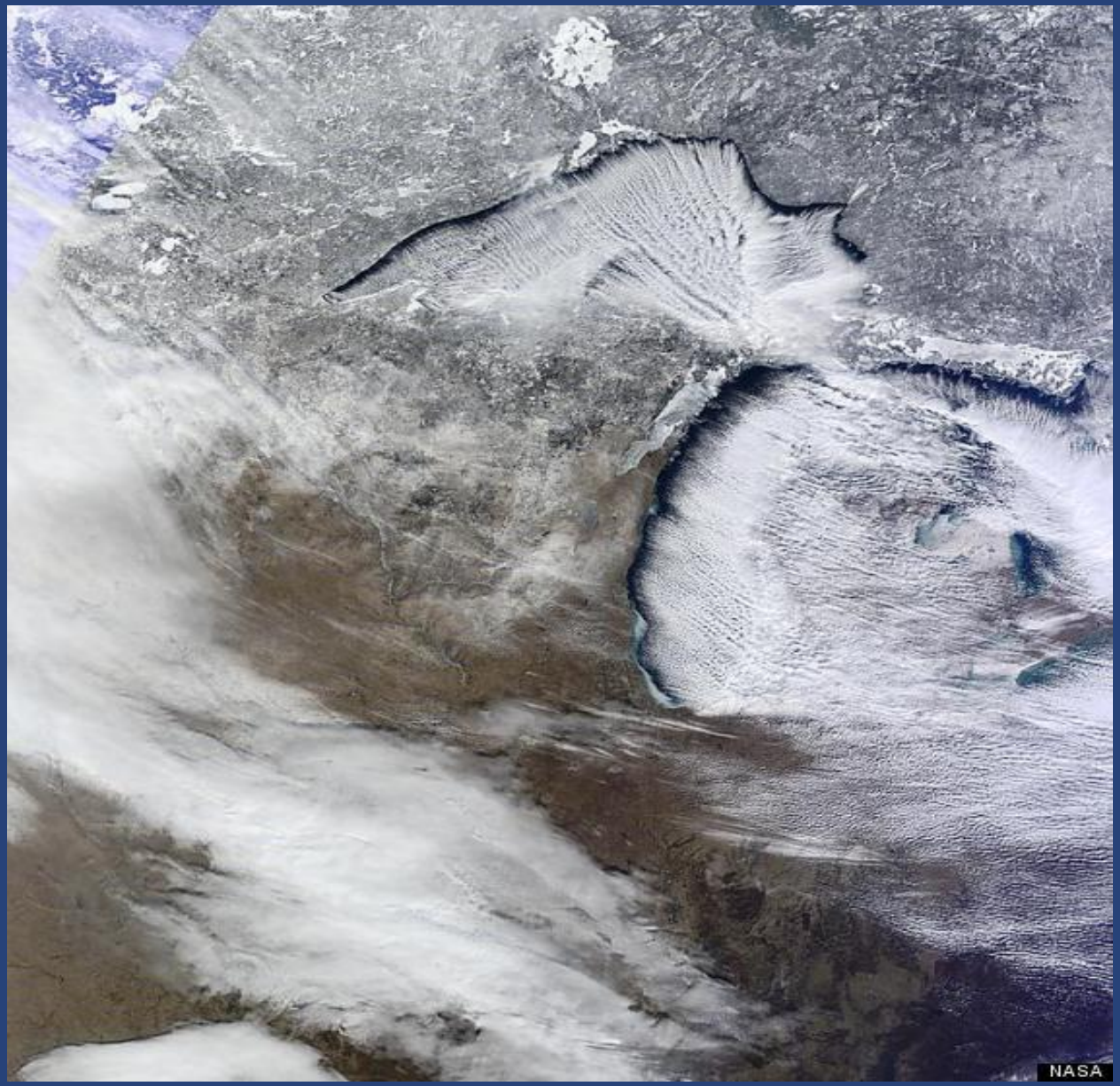
(for Lake Michigan)



How does lake effect snow form?



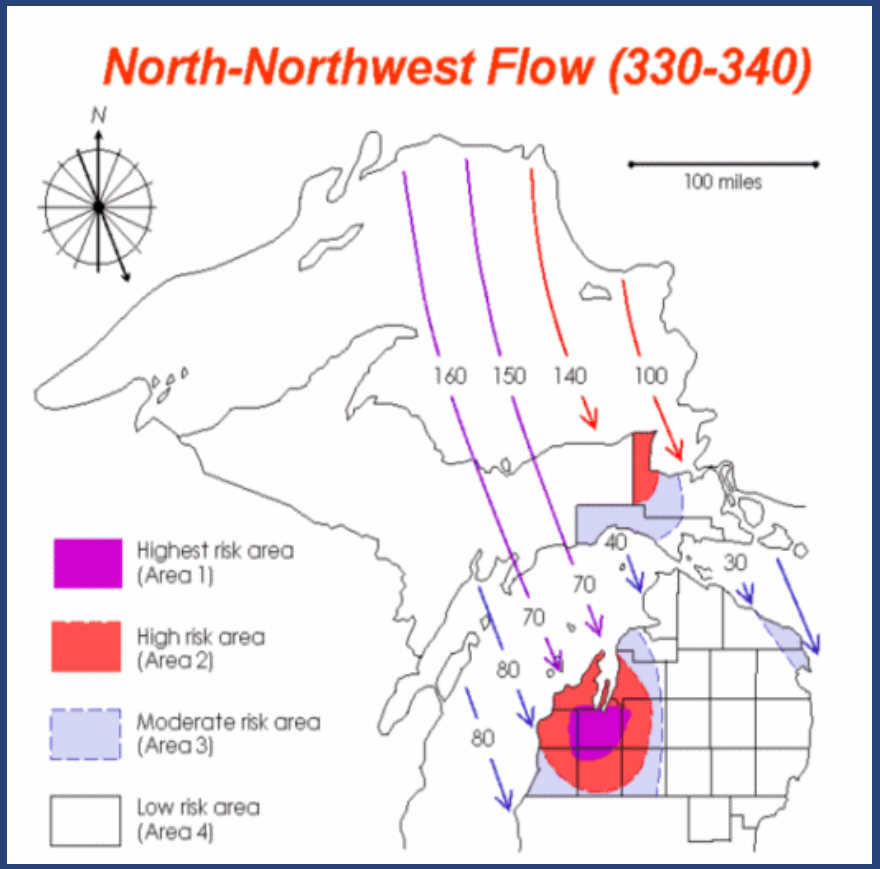
Lake effect snow on satellite



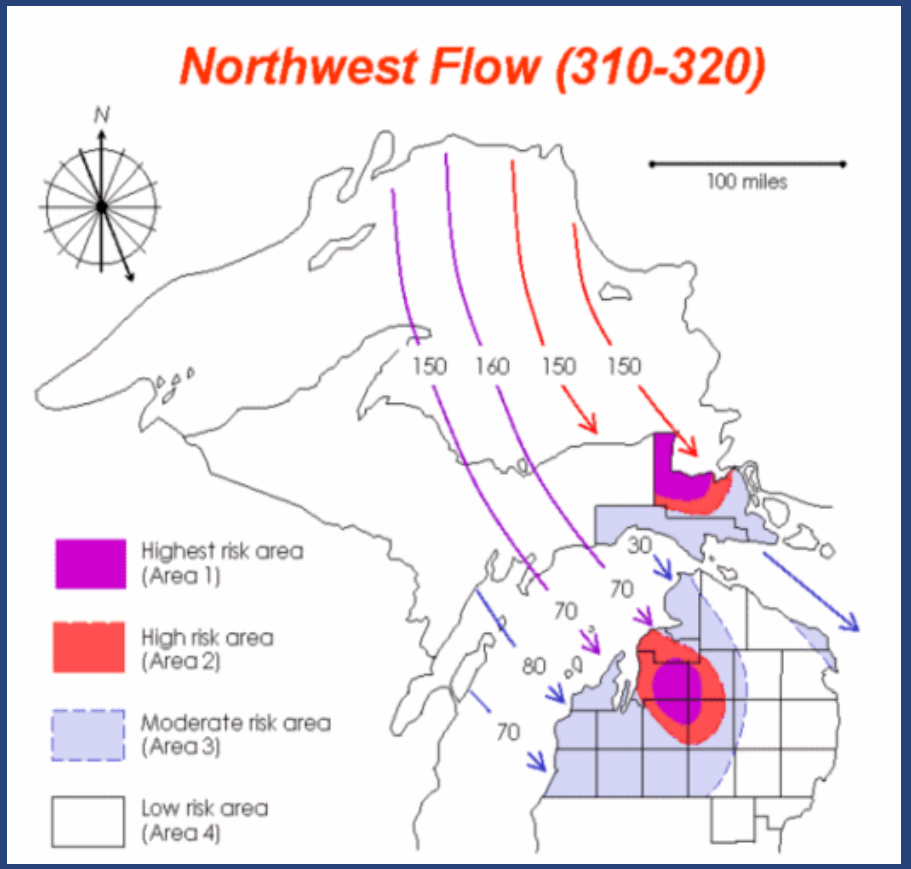
Snowfall forecast challenges

Challenge #1: Slight variations in wind direction

North-Northwest Flow

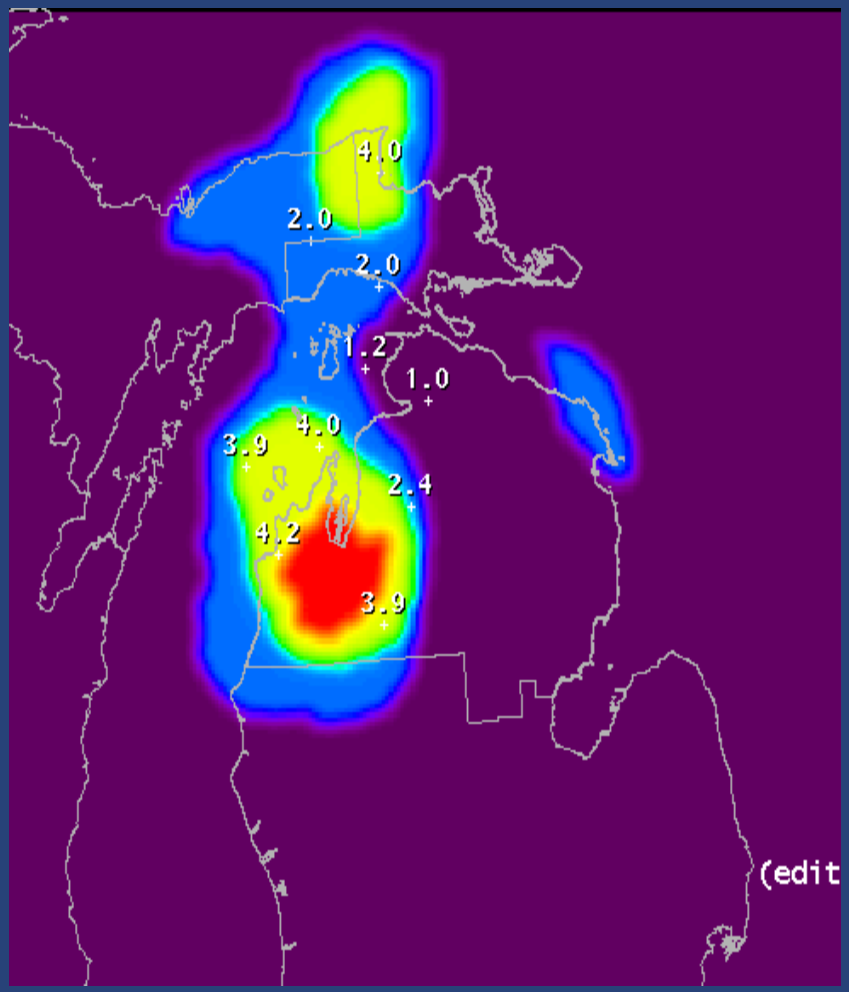


Northwest Flow

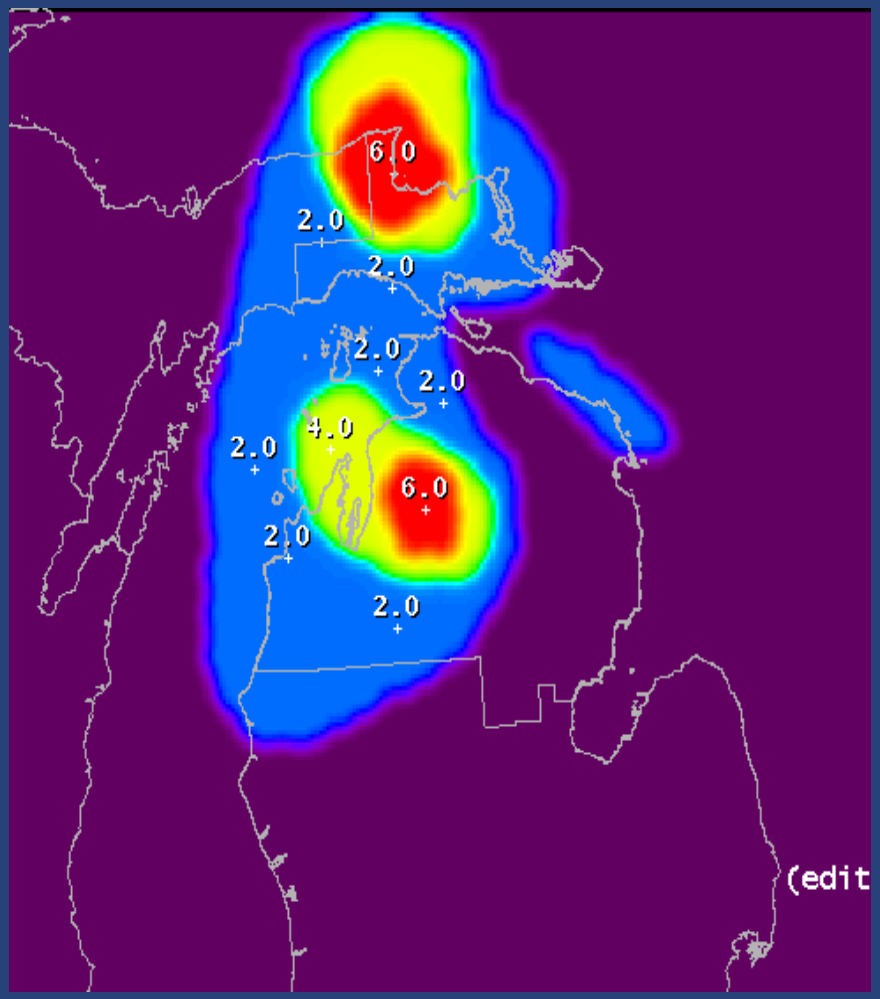


Challenge #1: Slight variations in wind direction

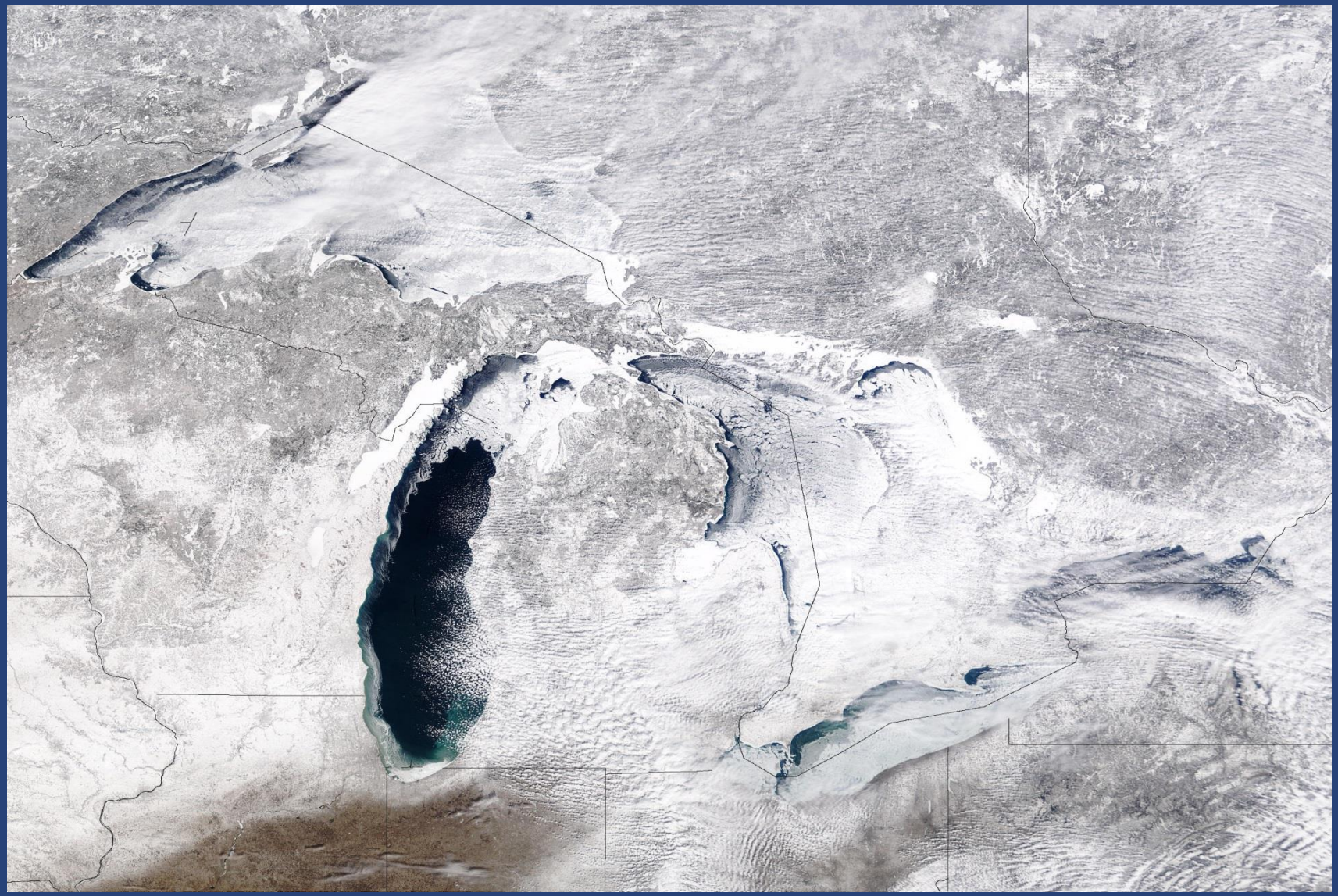
North-Northwest Flow



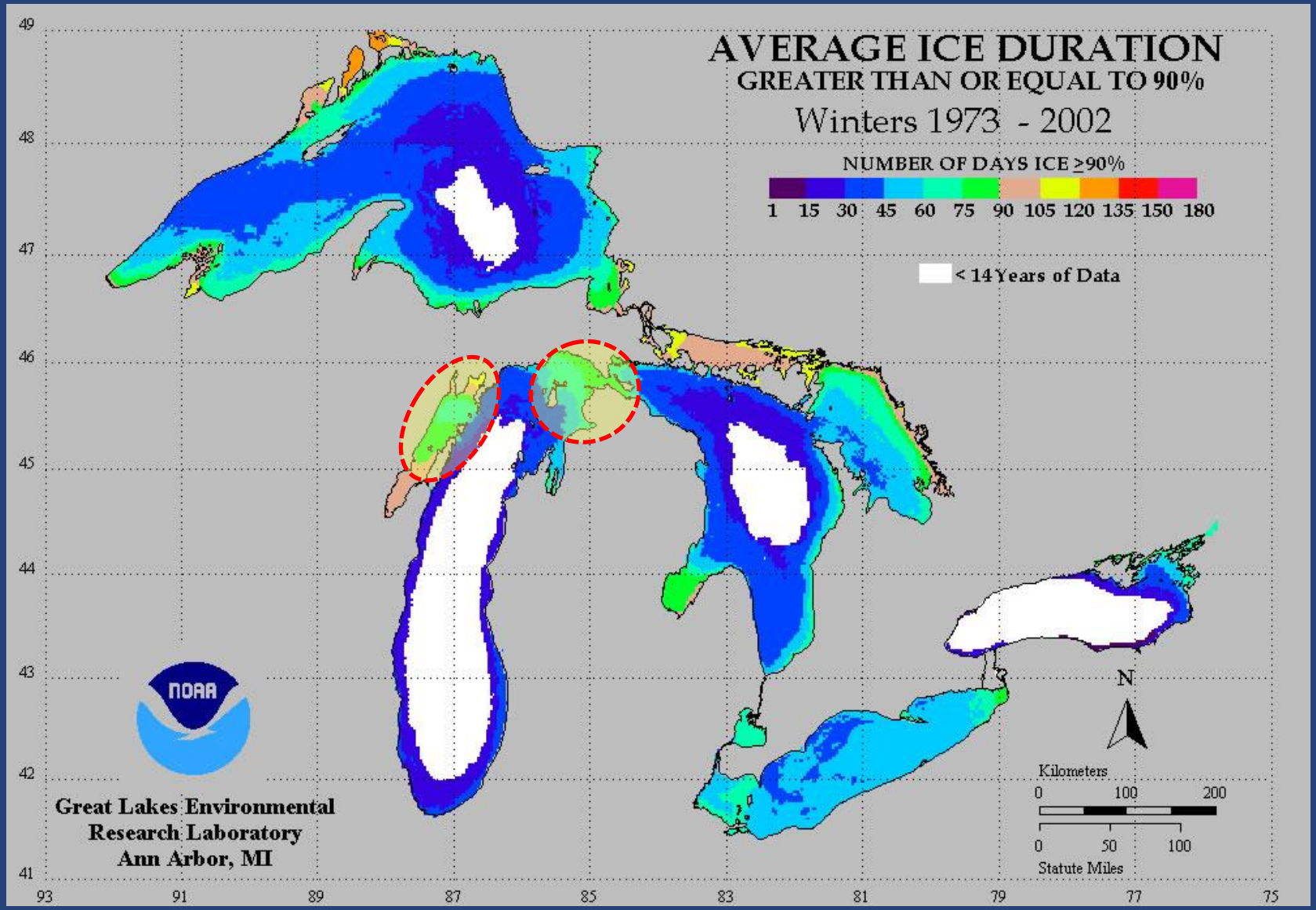
Northwest Flow



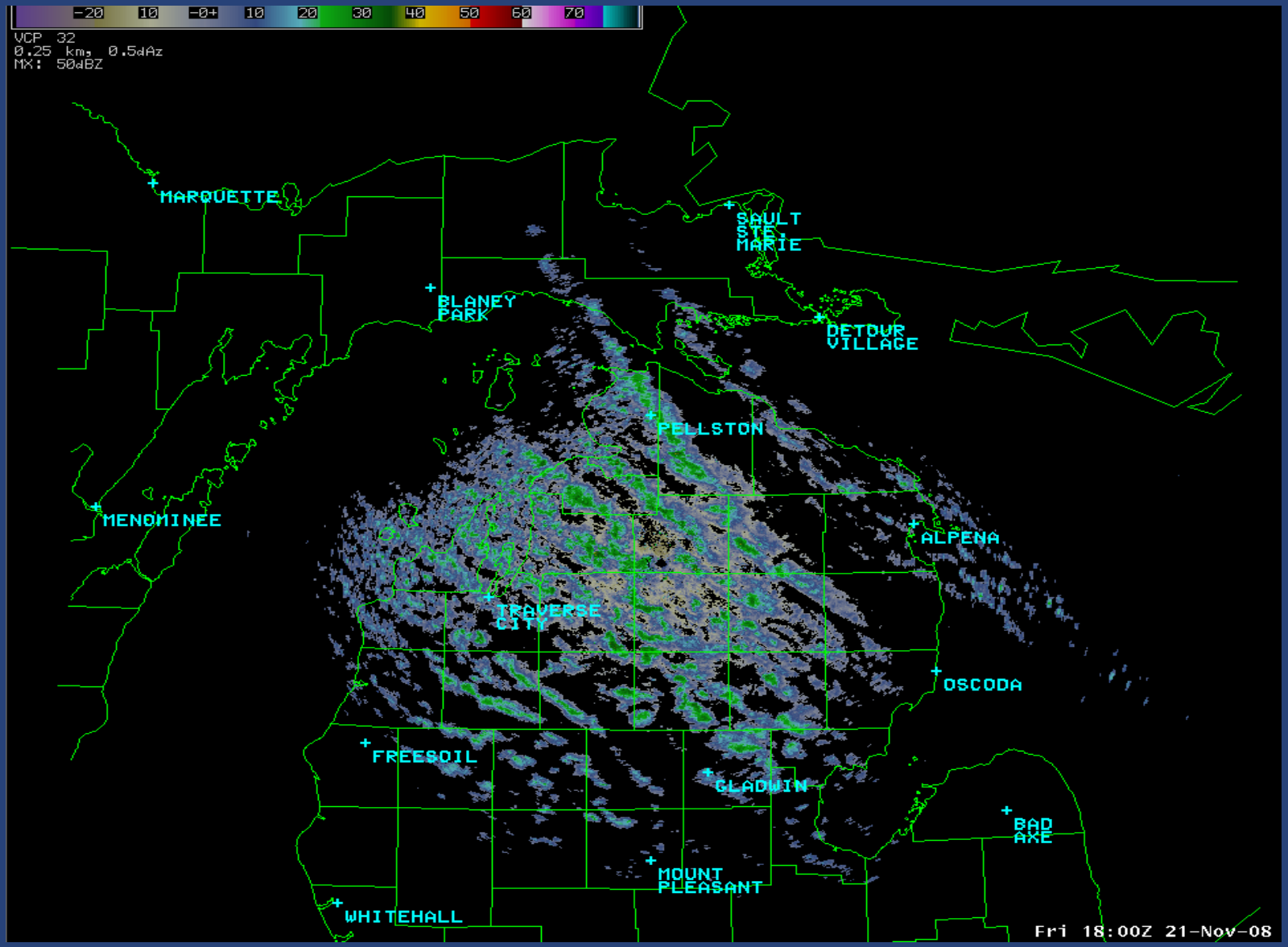
Challenge #2: Ice Cover



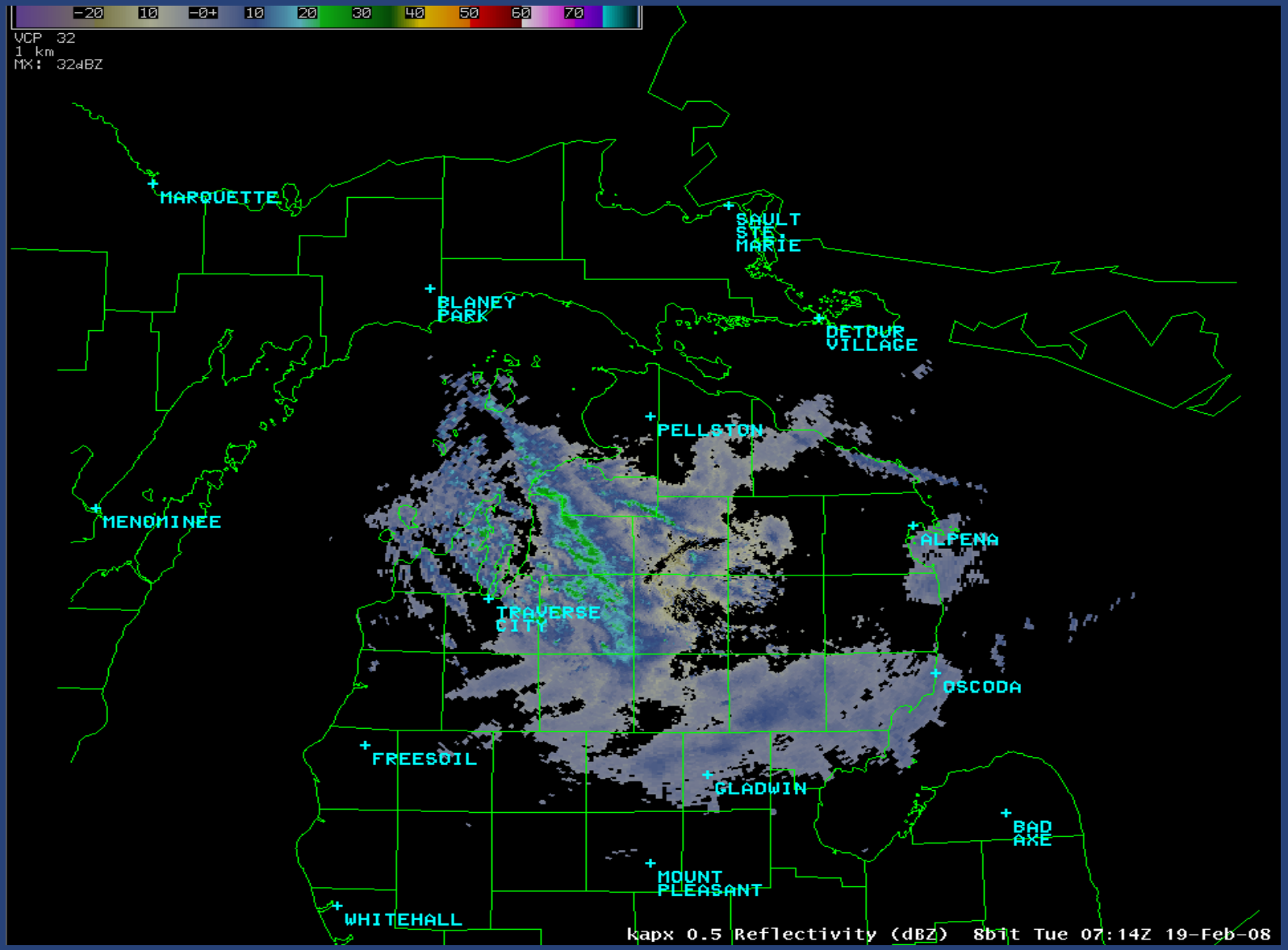
Average days of >90% ice cover



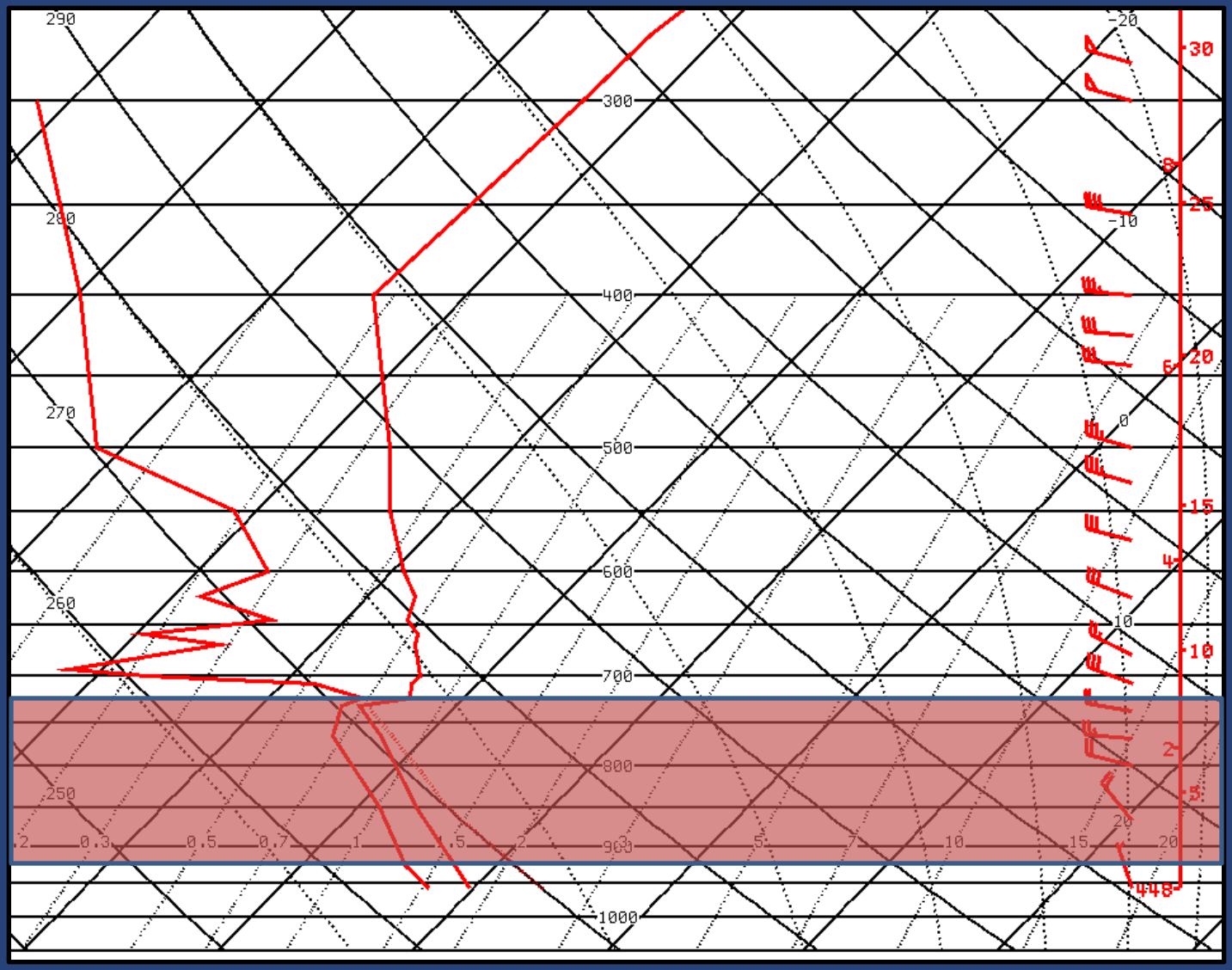
Northwest winds - No Ice cover



Northwest winds - Ice cover



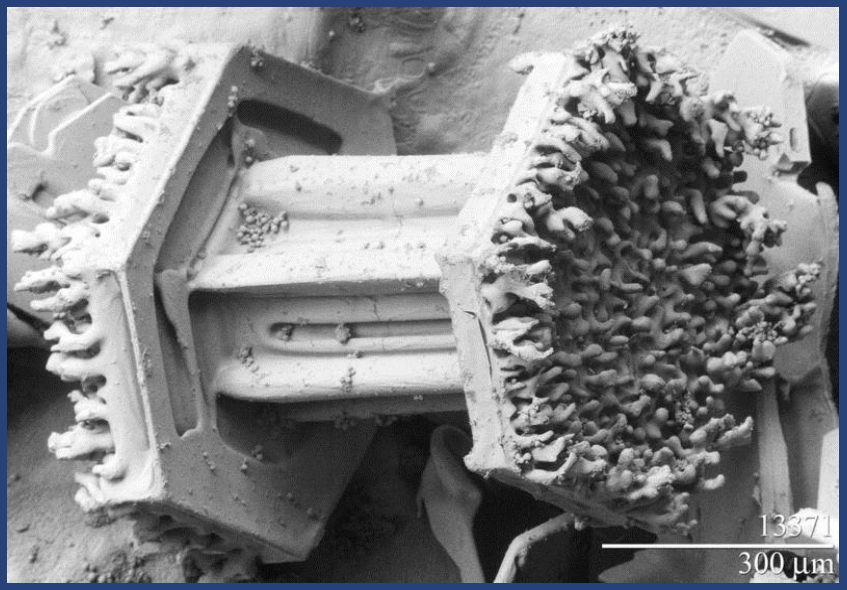
Challenge #3: Snowflakes and temperatures

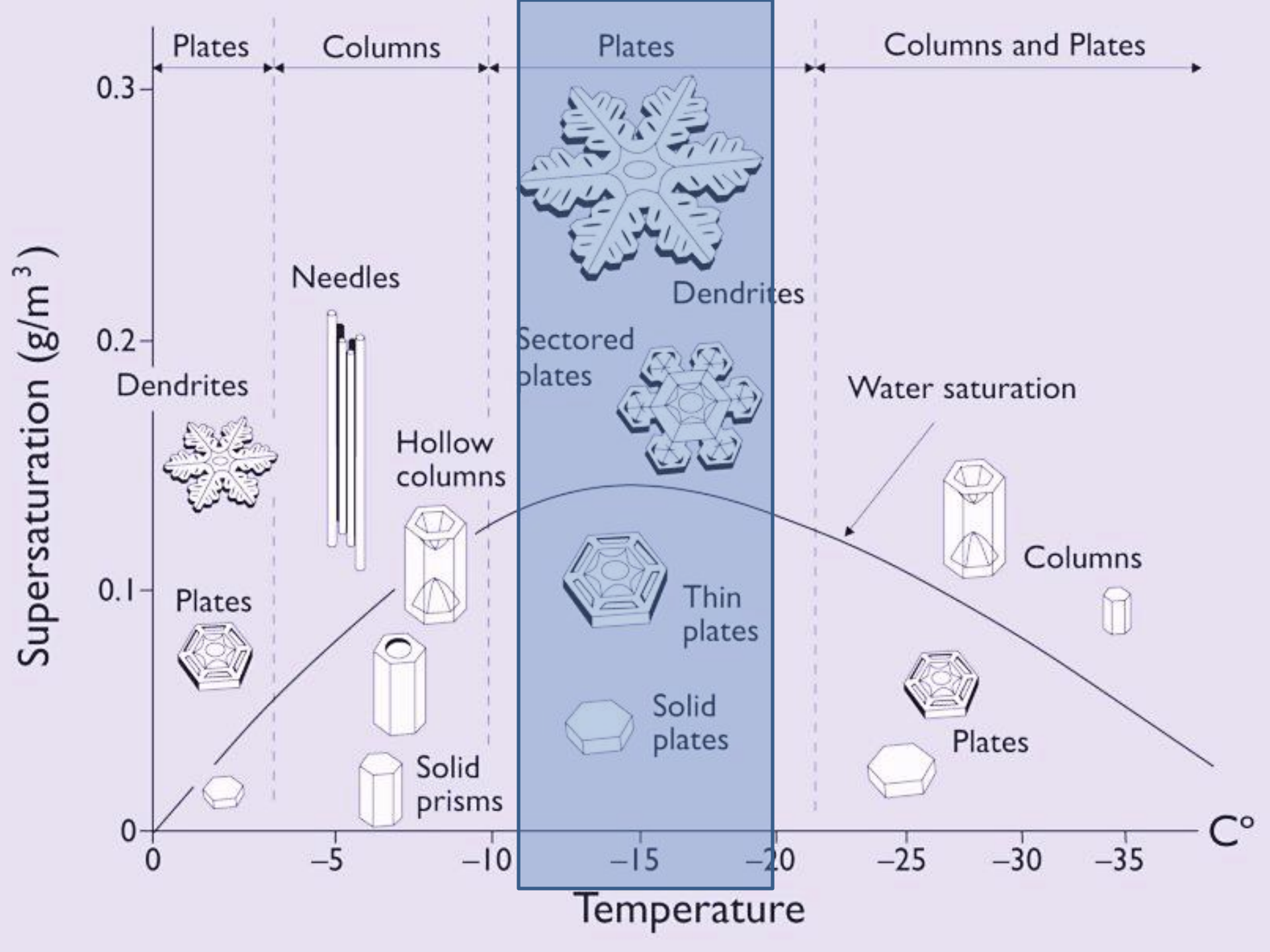


Temperatures aloft – the key

As temperatures aloft get colder, snowflakes become less dense. Less dense snowflakes may accumulate more quickly.

But as temperatures around 5000 feet fall below -20 degrees Celsius, snowfall intensity and accumulation drops off as snowflake size gets much smaller.



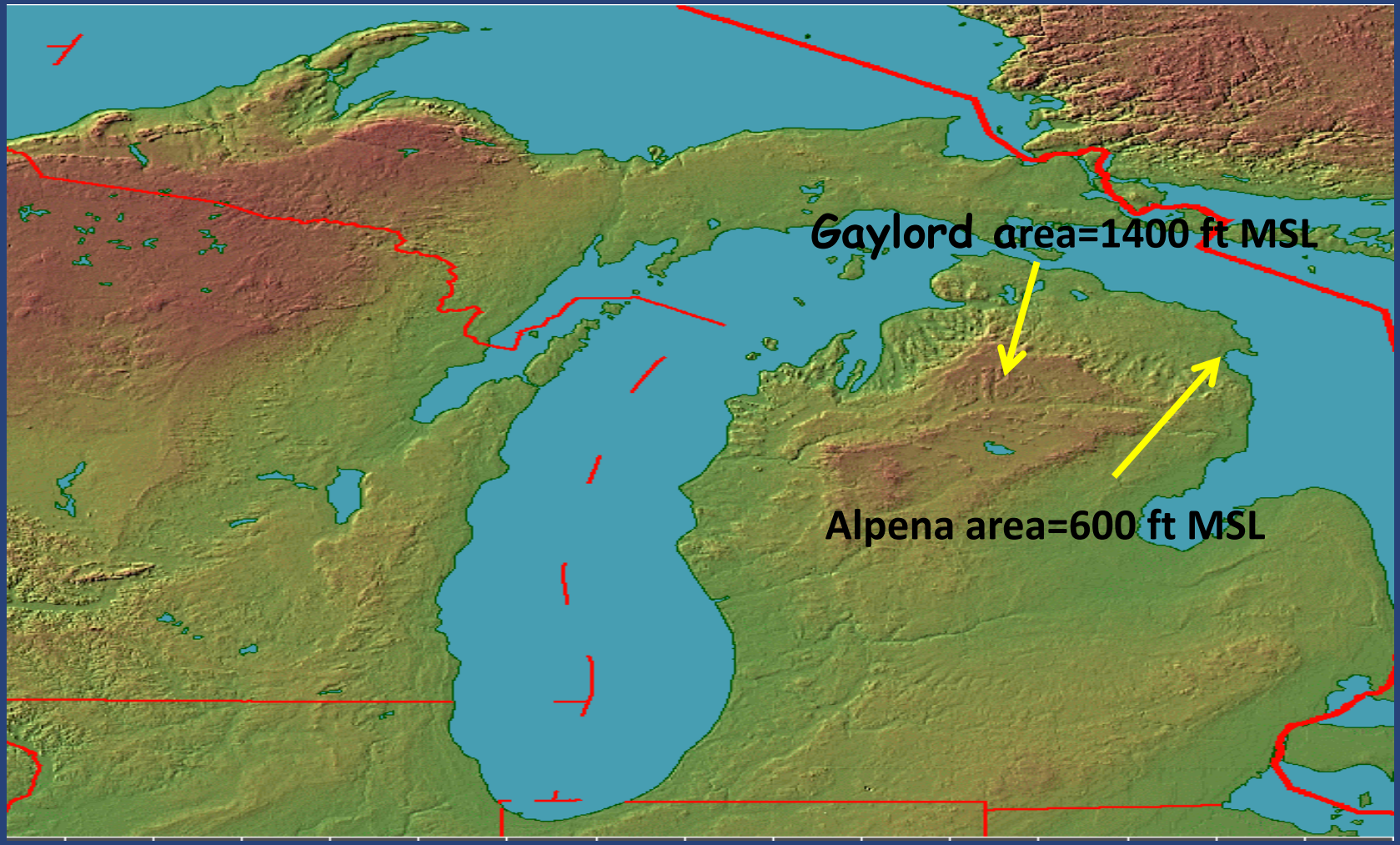

Plates
Columns
Plates
Columns and Plates
0.3
0.2
0.1
0
Supersaturation (g/m^3)
Needles
Dendrites
Dendrites
Sectored plates
Water saturation
Hollow columns
Columns
Plates
Thin plates
Solid plates
Plates
Solid prisms
C°
0
–5
–10
–15
–20
–25
–30
–35
Temperature

Dendrite Snowflake

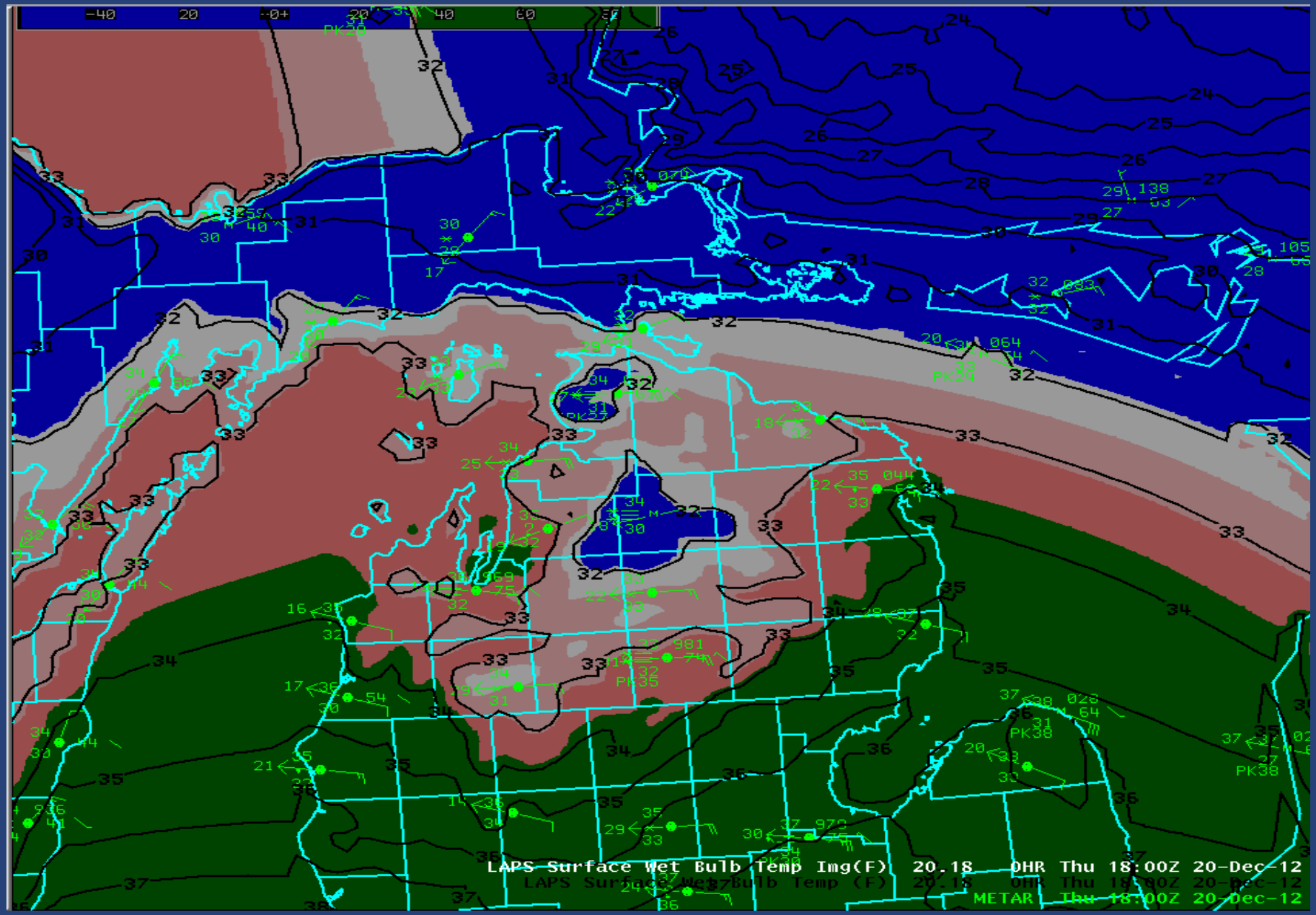
Column Snowflake

Challenge #4: Elevation

During snow events, temperatures drop approximately 1 degree Fahrenheit for every 300 foot rise in elevation



December 20-21, 2012 Snowstorm



December 20-21, 2012 Snowstorm

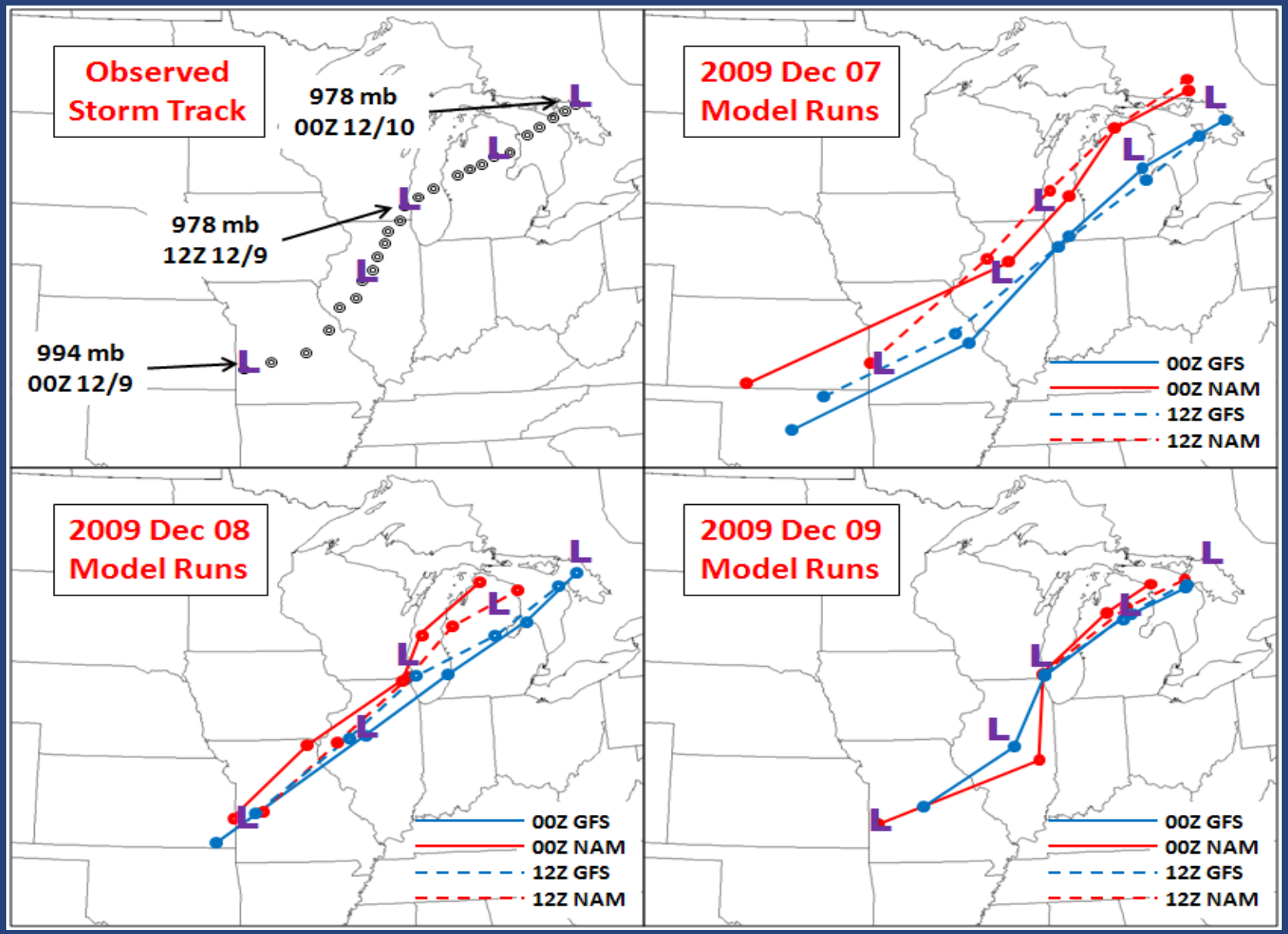
Gaylord Observations Elevation 1400 feet

9:53 AM	32.0 °F	24.2 °F	30.0 °F	92%	29.74 in	0.5 mi	East	9.2 mph	20.7 mph	0.04 in	Fog , Snow	Snow	
10:53 AM	32.0 °F	23.6 °F	30.9 °F	96%	29.71 in	0.2 mi	East	10.4 mph	19.6 mph	0.07 in	Fog , Snow	Snow	
11:53 AM	32.0 °F	24.2 °F	30.9 °F	96%	29.64 in	0.2 mi	East	9.2 mph	25.3 mph	0.11 in	Fog , Snow	Snow	
12:36 PM	33.8 °F	24.8 °F	30.2 °F	87%	29.52 in	0.5 mi	East	12.7 mph	20.7 mph	0.04 in	Fog , Snow	Snow	
1:31 PM	32.0 °F	22.5 °F	30.2 °F	93%	29.44 in	0.2 mi	East	12.7 mph	24.2 mph	0.03 in	Fog , Snow	Snow	
1:53 PM	32.0 °F	20.8 °F	30.9 °F	96%	29.43 in	-	East	17.3 mph	31.1 mph	0.05 in	Snow	Snow	

Alpena Observations Elevation 600 feet

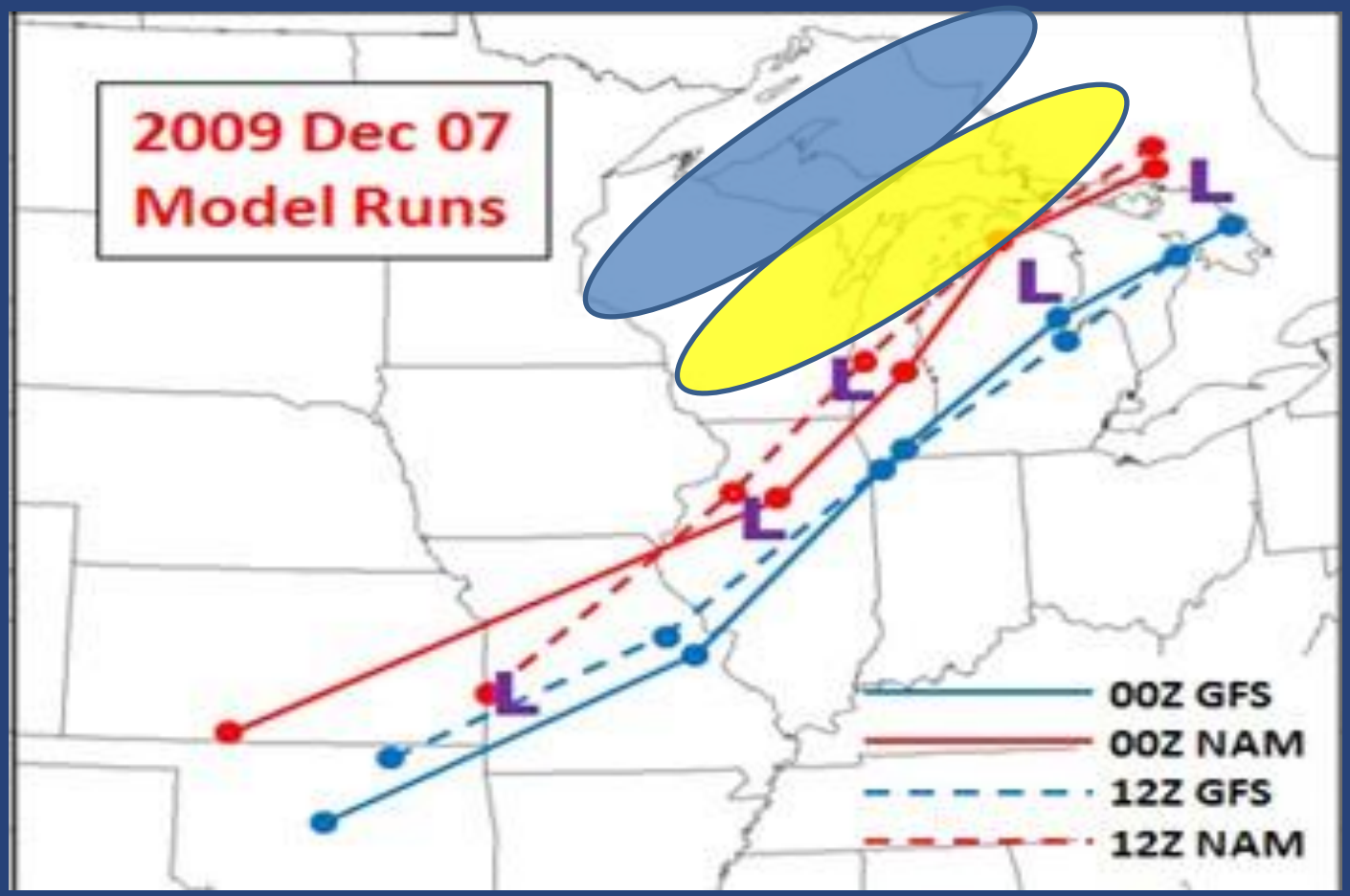
10:54 AM	35.1 °F	24.5 °F	33.1 °F	92%	29.80 in	5.0 mi	ESE	18.4 mph	27.6 mph	0.00 in	Rain	Light Rain
11:11 AM	35.6 °F	24.8 °F	33.8 °F	93%	29.76 in	2.0 mi	ESE	19.6 mph	33.4 mph	0.03 in	Rain , Snow	Light Rain
11:17 AM	33.8 °F	22.8 °F	33.8 °F	100%	29.76 in	1.5 mi	ESE	18.4 mph	31.1 mph	0.05 in	Rain , Snow	Light Rain
11:38 AM	33.8 °F	23.2 °F	32.0 °F	93%	29.74 in	0.8 mi	ESE	17.3 mph	31.1 mph	0.09 in	Snow	Light Snow
11:48 AM	33.8 °F	23.5 °F	32.0 °F	93%	29.73 in	0.2 mi	ESE	16.1 mph	25.3 mph	0.12 in	Fog , Snow	Heavy Snow
11:54 AM	33.1 °F	21.9 °F	30.9 °F	92%	29.74 in	0.2 mi	ESE	18.4 mph	27.6 mph	0.14 in	Fog , Snow	Heavy Snow
12:06 PM	33.8 °F	22.8 °F	32.0 °F	93%	29.70 in	0.5 mi	ESE	18.4 mph	25.3 mph	0.03 in	Fog , Snow	Snow
12:22 PM	33.8 °F	24.8 °F	32.0 °F	93%	29.68 in	2.5 mi	East	12.7 mph	23.0 mph	0.04 in	Snow	Light Snow
12:26 PM	33.8 °F	24.8 °F	32.0 °F	93%	29.67 in	5.0 mi	East	12.7 mph	23.0 mph	0.04 in	Snow	Light Snow
12:47 PM	35.6 °F	25.2 °F	33.8 °F	93%	29.65 in	8.0 mi	East	18.4 mph	26.5 mph	0.04 in		Overcast
12:54 PM	35.1 °F	24.8 °F	33.1 °F	92%	29.66 in	8.0 mi	East	17.3 mph	25.3 mph	0.04 in	Rain	Light Rain

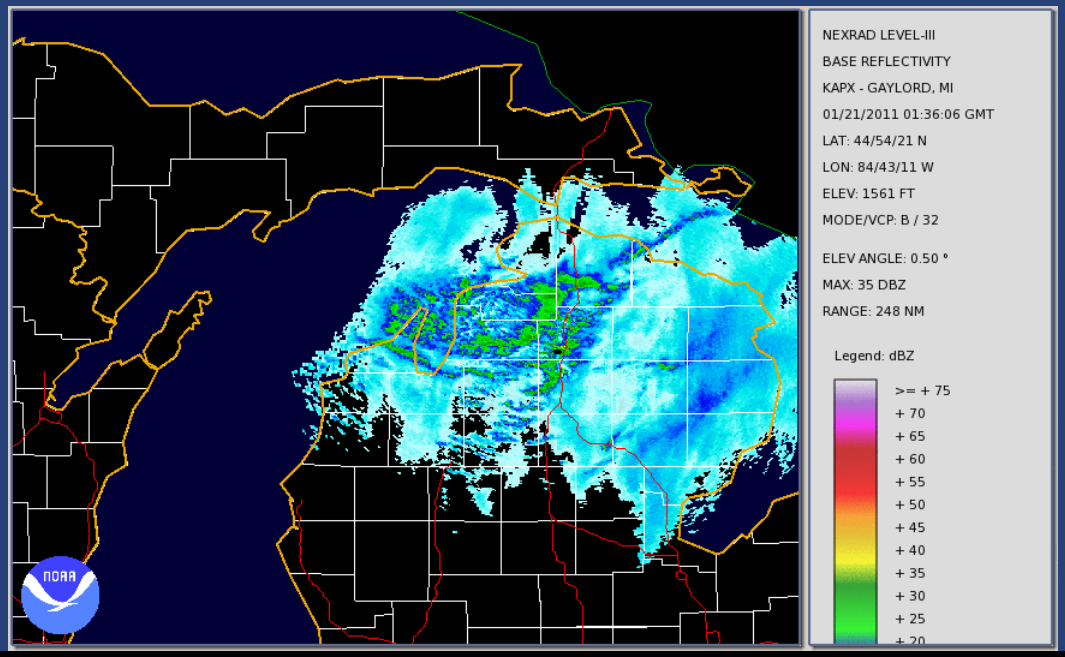
Challenge #5: Computer models

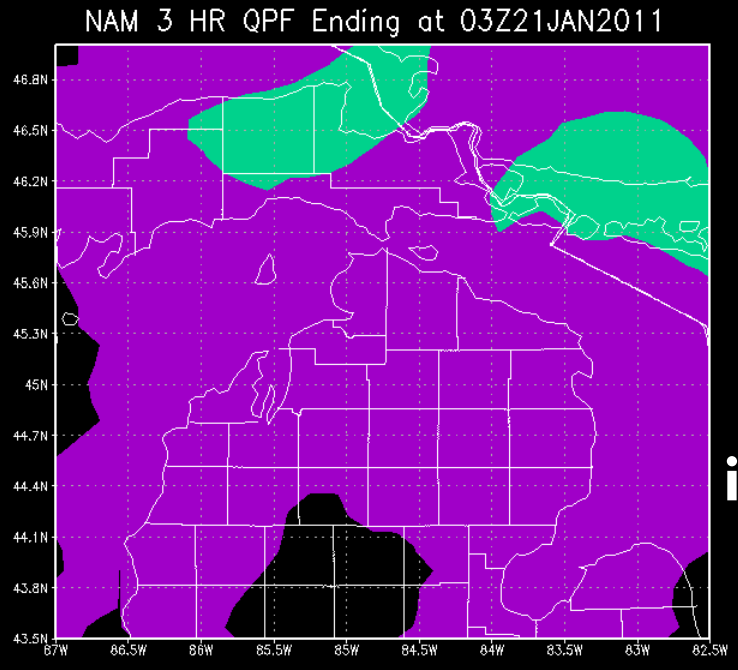


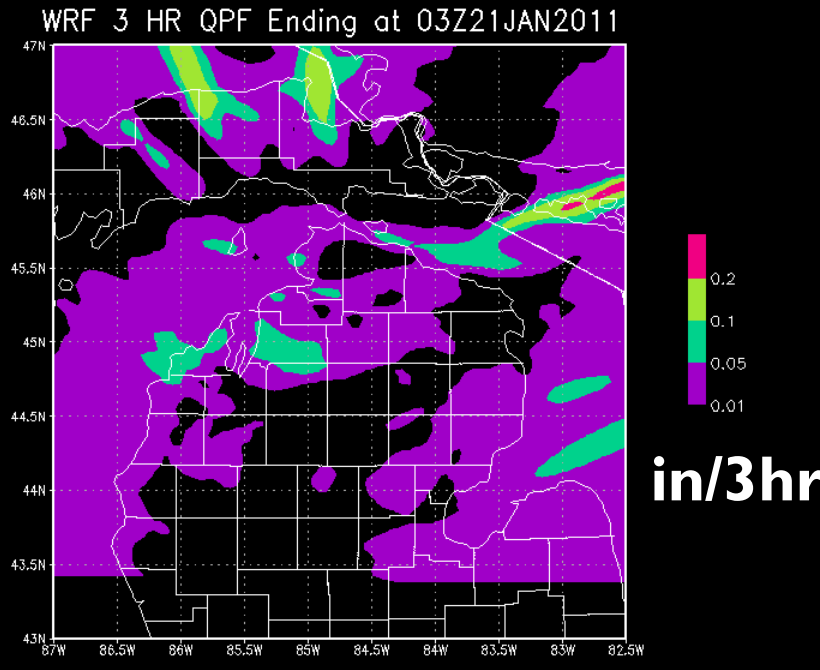
Why is storm track important?

Heaviest snow normally falls 150 to 200 miles to the left of the surface low track

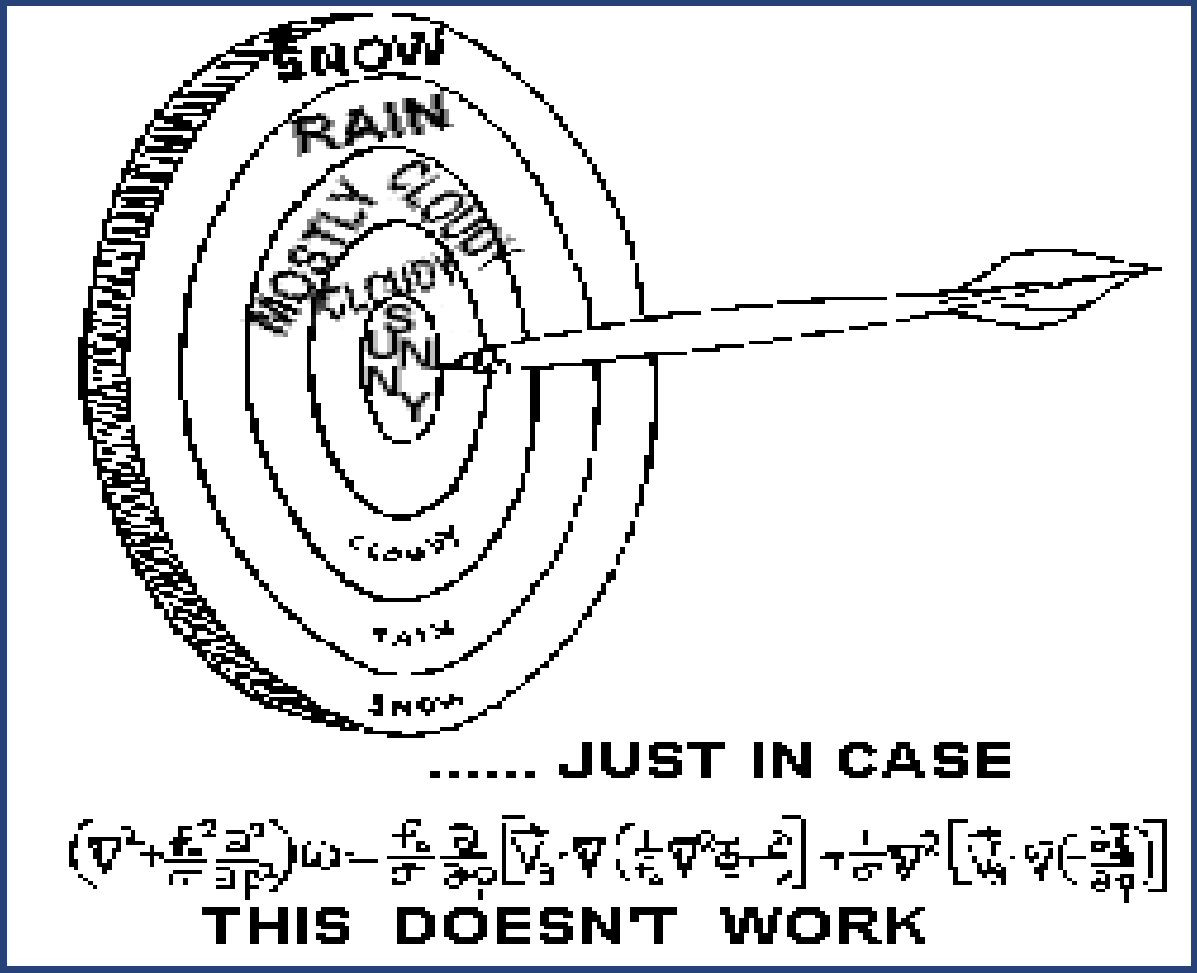



NEXRAD LEVEL-III
BASE REFLECTIVITY
KAPX - GAYLORD, MI
01/21/2011 01:36:06 GMT
LAT: 44/54/21 N
LON: 84/43/11 W
ELEV: 1561 FT
MODE/VCP: B / 32
ELEV ANGLE: 0.50 °
MAX: 35 DBZ
RANGE: 248 NM
Legend: dBZ
>= + 75
+ 70
+ 65
+ 60
+ 55
+ 50
+ 45
+ 40
+ 35
+ 30
+ 25
+ 20
NOAA


NAM 3 HR QPF Ending at 03Z21JAN2011
46.8N
46.5N
46.2N
45.9N
45.6N
45.3N
45N
44.7N
44.4N
44.1N
43.8N
43.5N
87W
86.5W
86W
85.5W
85W
84.5W
84W
83.5W
83W
82.5W
0.2
0.1
0.05
0.01
in/3hr


WRF 3 HR QPF Ending at 03Z21JAN2011
47N
46.5N
46N
45.5N
45N
44.5N
44N
43.5N
43N
87W
86.5W
86W
85.5W
85W
84.5W
84W
83.5W
83W
82.5W
0.2
0.1
0.05
0.01
in/3hr

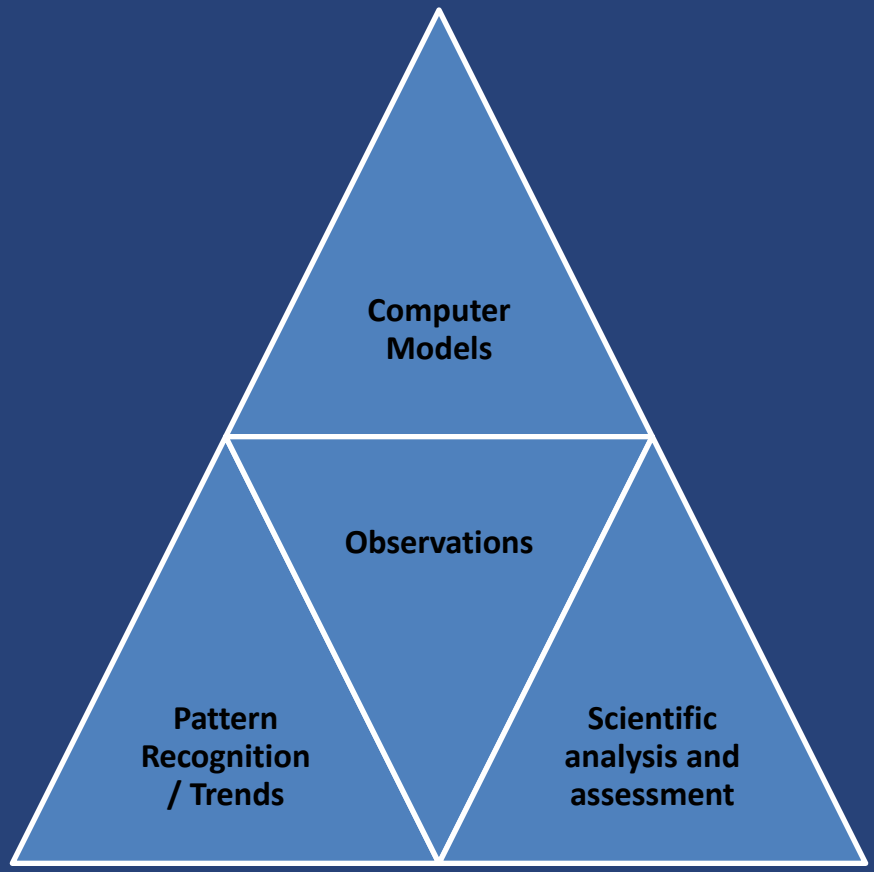
With all of these challenges…How do meteorologists put the forecast together?



With all of these challenges…How do meteorologists put the forecast together?

Creating a Forecast: Like putting a puzzle together

- Current observations
- Various computer models
- Pattern recognition
- Forecaster expert analysis and assessment



Questions???

Jim Keysor
Warning Coordination Meteorologist
NWS Gaylord

989-731-3384 Ext 726

james.keysor@noaa.gov
www.weather.gov/gaylord